Micro-pulse Lidar Measurements in South China Sea Expedition

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The South China Sea is the third largest inland sea in the world, with unique geographical and climatic conditions, and great economic importance. Observation of aerosols over this region is needed to understand their role in cloud, radiation, and ocean primary production. While the optical properties of marine aerosols over the South China Sea have been studied using solar photometers, there are no lidar studies for this region that the authors know of in publicly accessible scientific literature.

To test the viability of shipborne lidar for aerosol measurement over the South China Sea, a shipborne micro-pulse lidar (Mini-MPL) was used to measure aerosol extinction coefficient in the northern region of the South China Sea over a period of one month from 9th August to 7th September, 2016, along the cruise path of a research vessel. The measurements were inverted to obtain vertical profiles of aerosol extinction coefficient, depolarization ratio, and atmospheric boundary layer height using Mie Theory and the Fernald method. Aerosols were found to be concentrated low in the atmosphere, with more than 73% of total extinction below 2 km and almost no aerosol above 3.5 km. Maximum extinction values in coastal areas were generally about double of values in offshore areas. The aerosol concentration was lower in the northwest side of the South China Sea compared to the northeast side, a pattern that may due to advection by the prevailing summer southwesterly winds. Vertical profiles and back-trajectory calculations indicated vertical and horizontal layering of aerosols from different terrestrial sources. The mean depolarization ratio of the aerosols along the cruise was 0.042. Atmospheric boundary layer height along the cruise was average 653.2 m, with a diurnal cycle reaching its mean maximum of 1041.2 m at 12:00, and its mean minimum of 450.0 m at 20:00.